College of Engineering & Applied Science
UNIVERSITY OF COLORADO BOULDER

CU Mechanical Engineering Senior Design 2021-2022

In Mechanical Engineering at CU Boulder, Senior Design is viewed as a transitional experience moving students from the classroom and preparing them to embark successfully on their careers. The learning objectives for Senior Design go beyond the technical execution of a design project. Recognizing that design is a social process, the course includes teamwork, social, communication, and professional skills as key outcomes for professional development.

There are two sections of ME Senior Design at CU – an Industry-Sponsored section and an Engineering for Social Innovation (ESI) section. The learning objectives for the course are identical and the same resources will be available to students across both sections.

Industry-Sponsored Section

In the industry-sponsored section of senior design, teams of five or six students are paired with industry clients and faculty directors to design and build a system based on the needs and specifications of a client. The clients range from small companies to large corporations, from individual entrepreneurs to multi-national organizations, and from start-ups to well-established entities. Each team is eligible for a budget of $2,000 for project materials; some companies will supplement these budgets up to tens of thousands of dollars.

Students are matched with industry sponsors through a team application process. First, student teams are formed based on common interests, skill, and experience. Each team then writes up to seven team applications to the company clients from their preferred projects. Clients evaluate team applications and rank the teams. If a team receives top ranking from their first-choice project, an automatic match is made between that team and project. Otherwise, teams and projects are matched to optimize the placement of student teams with clients and projects. *Note*: over the last five years, more than 85% of teams have been matched with one of their top four company choices.

Teams progress through the design process beginning with customer needs clarification, moving to design reviews demonstrating alignment with customer specifications, proceeding through several rounds of analysis and prototyping, and ending with the manufacture and assembly of a trade-show ready prototype (unless project needs require otherwise). Throughout the design cycle, teams meet weekly with a faculty mentor, called a Director, and an Industry Client from the sponsoring company. The outcomes of these projects are displayed at the ME Design Expo and the ME Showcase Website, except where intellectual property and patent-applications prohibit public display.

The industry-sponsored section also houses the SAE Baja Vehicle competition team. Selection for this team is made through an interview process in the summer. Students on the competition team are encouraged to take a special topics course: *Advanced Vehicle Design*, due to the significant time commitment and responsibility associated with this project. *Advanced Vehicle Design* counts as an upper level ME technical elective. A separate application for Baja will be sent to those who indicate interest in the Baja team on their Senior Design application due May 7th. Those who have interest in Baja must complete the general application. Students should apply for either the industry-sponsored or ESI section in the case they are not selected for the Baja team.

Next year we will also "play along" in NREL's National Collegiate Wind Competition, meaning that our students will complete the competition design challenge, but will not be entered into the competition. A strong showing this year may secure a competition slot in future years. The team will be mentored by a wind energy professional with over fifteen years of experience. Information about this competition will be sent to students over the summer. Those who have interest in the Wind team must complete the general application. Students should apply for either the industry-sponsored or ESI section in the case they are not selected for the Wind Energy Team.

Engineering for Social Innovation

The Engineering for Social Innovation section provides an opportunity for students to explore innovation and entrepreneurship by progressing a design problem from ideation to manufacturing.

Projects in this section will be focused on products or processes that have some societal impact. Students are encouraged to pursue opportunities in design that address issues in developing countries, underprivileged domestic populations, sustainability, and the environment. Projects undergo a proposal and funding process in order to ensure that they are scoped properly for team size, budget, and two-semester schedule. The project should be scoped for completion given ten to fifteen hours of time per week for each team member for approximately 30 weeks. Funding will be provided to each team in the same amount as the industry-funded section of the course. This is up to $2000 for Phase I funding. However, additional Phase II funding may be made available to select teams based on a secondary proposal process.

The existing Senior Design administrative structure and facilities are used with some modifications to course curriculum. Student teams will be held to the same standards across all sections and are expected to have the same general course outcomes. Projects will end at the same level of completion, although the ESI section will necessarily start earlier in the design process. Course Instructors and Project Directors will evaluate projects, oversee the overall design, and ensure that the projects meet all Senior Design course goals and requirements.

Student Placement

Students will be placed into sections by an application and review process. Applications will be due on May 7th, 2021 at midnight. Placement will be announced by July 1st, 2021.

Part of the overarching goal of Senior Design is to provide our students the experience that employers and industry partners are expecting of entry-level engineers. Although we encourage students that do not have industry experience or will not have completed an internship prior to graduation to participate in the Industry-Sponsored section of the course, this is not a strict requirement. Additionally, students that plan on pursuing an advanced degree in the department and expect to pass through Graduate Design as part of their degree (e.g., BS/MS in the Design Track) may not be candidates for the ESI section.